

Water Supply and Flood Forecasting with Climate Change

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Acknowledgments

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Presentation Outline

- Introduction
- Historical Trends
- Climate Change Information
- Impacts
- Future Work



Marsh/Delta/Bypass flyover 1/4/06

How much of the New Year's flooding
was due to climate change?

Photo by Ralph Finch

N 38° 19' 37.6" W 121° 41' 19.1" 865 ft WGS 84

4:47:40 PM

Introduction

- Climate vs. Weather – Climate is what you expect and weather is what you get
- Global Circulation Models aim to predict climate change
- Individual weather events may vary greatly
- New Year's event within historical observed variability



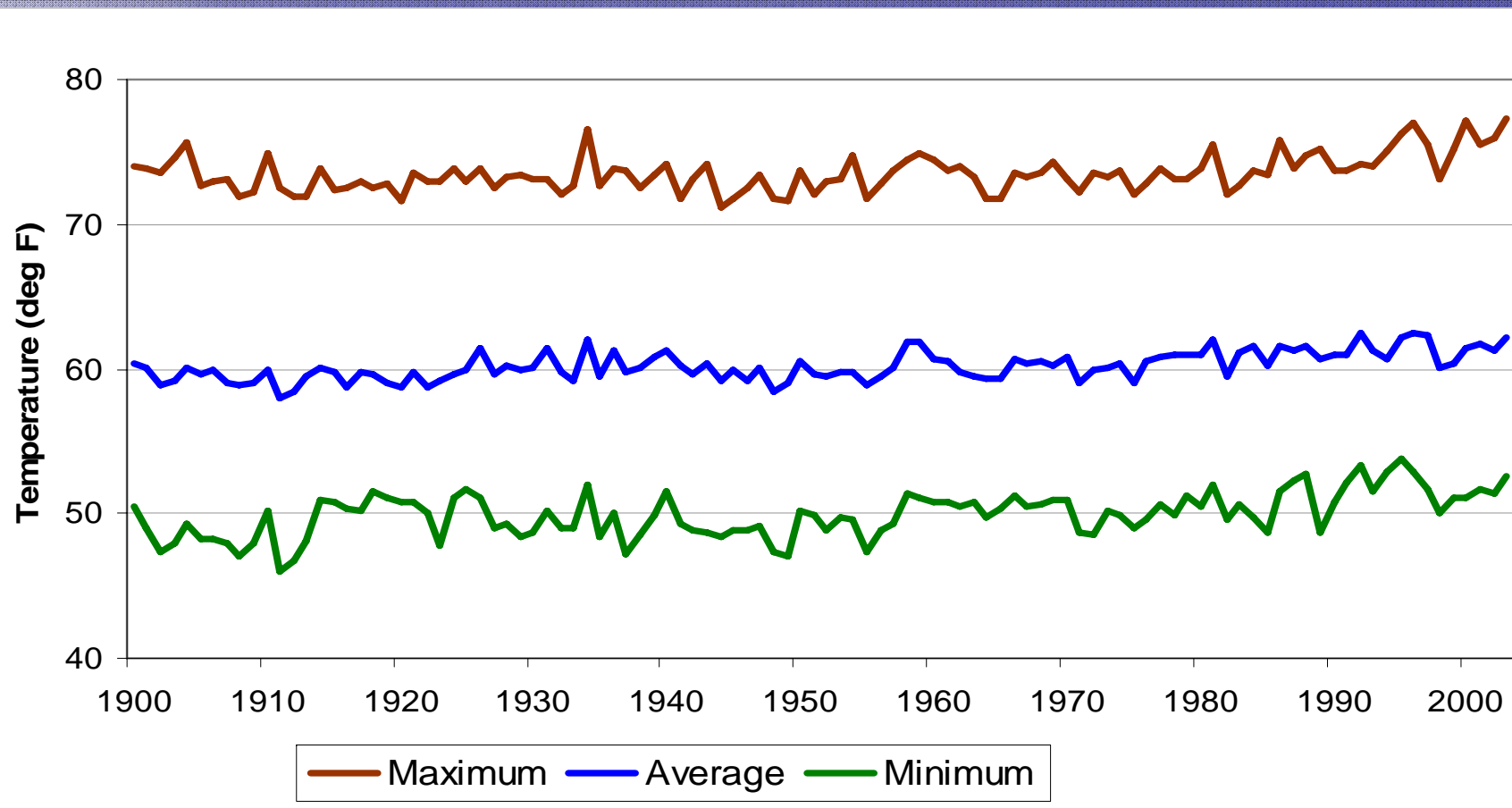
Introduction

- Climate Change impacts of note for flood/water supply forecasting:
 - Temperature
 - Precipitation type (snow vs. rain)
 - Seasonal shifts in precipitation or snowmelt
- Examine historical record for trends
- Look at climate change data for possible future scenarios



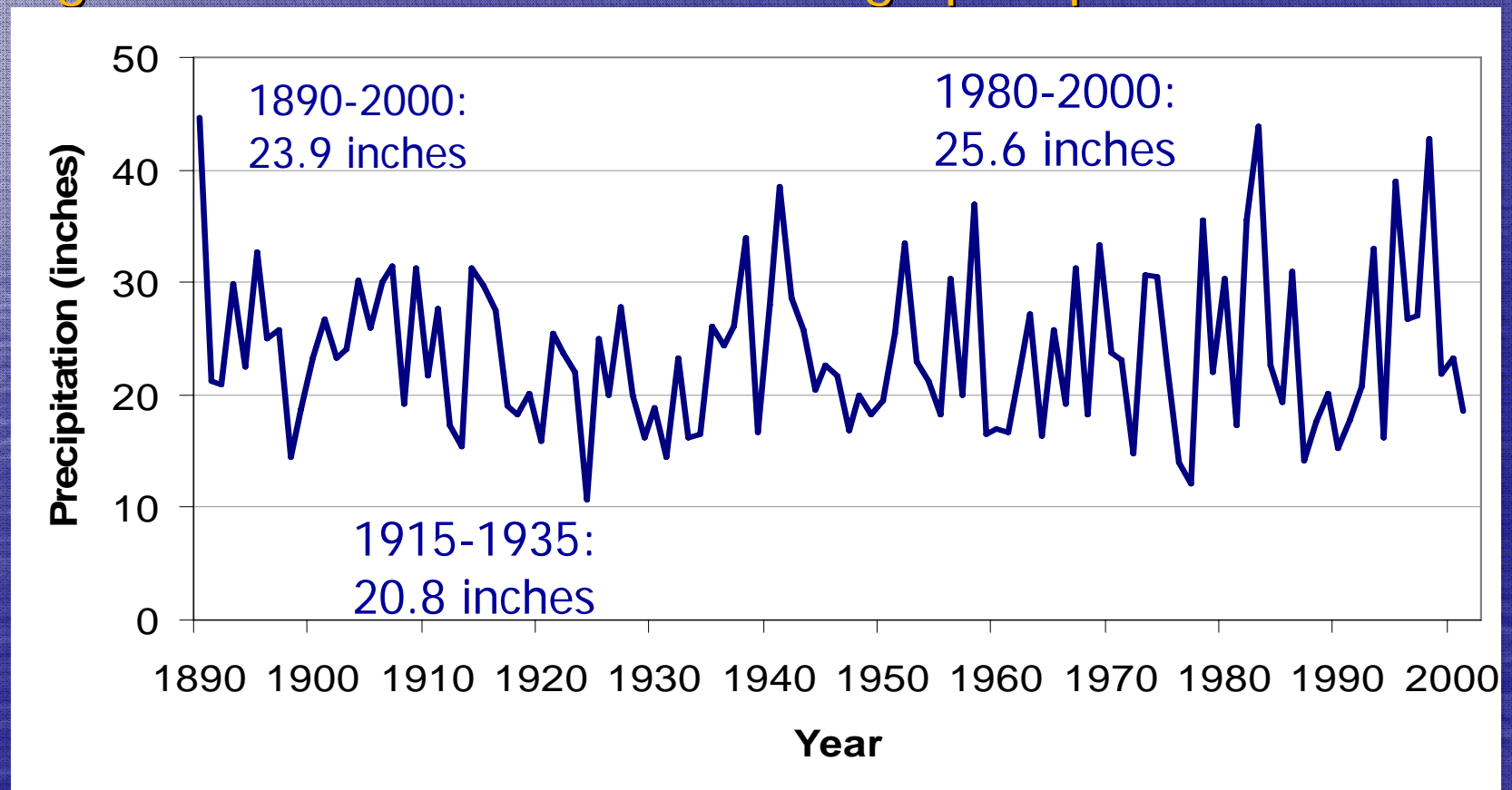
Historical Trends - Temperature

- Statewide average observed warming of about 0.5 °C (1 °F)



Historical Trends Precipitation

- Slight Increase in statewide average precipitation



Changes in Peak Runoff Statistics

Pre/Post 1955	Feather	Tuolumne	Eel
Mean	42/52	12/17	93/123
Standard Deviation	33/50	11/19	48/84
Range	145/232	52/91	165/489

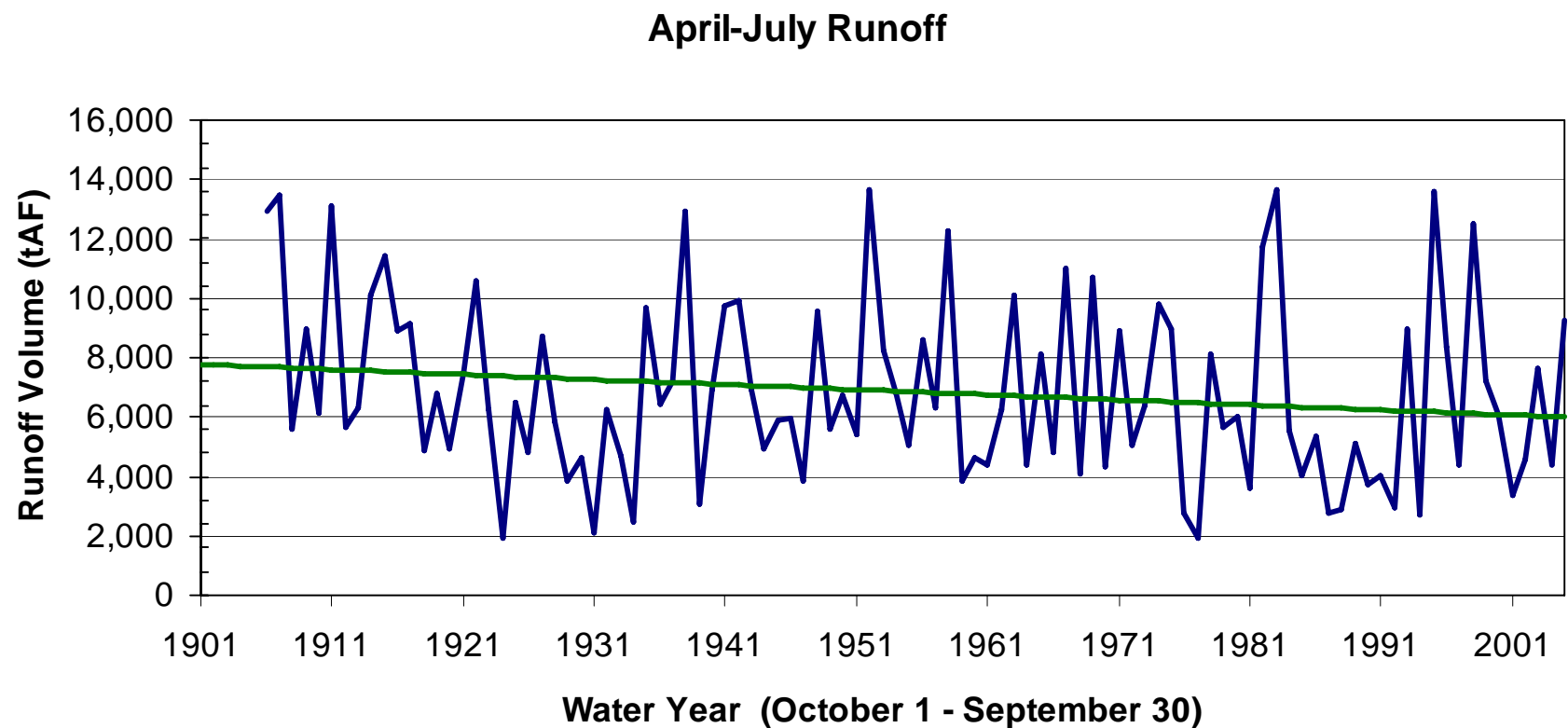
Values in 1000 cfs for annual peaks of 3-day average flows
1904-2004 data used for analysis

Range is maximum-minimum values for time period



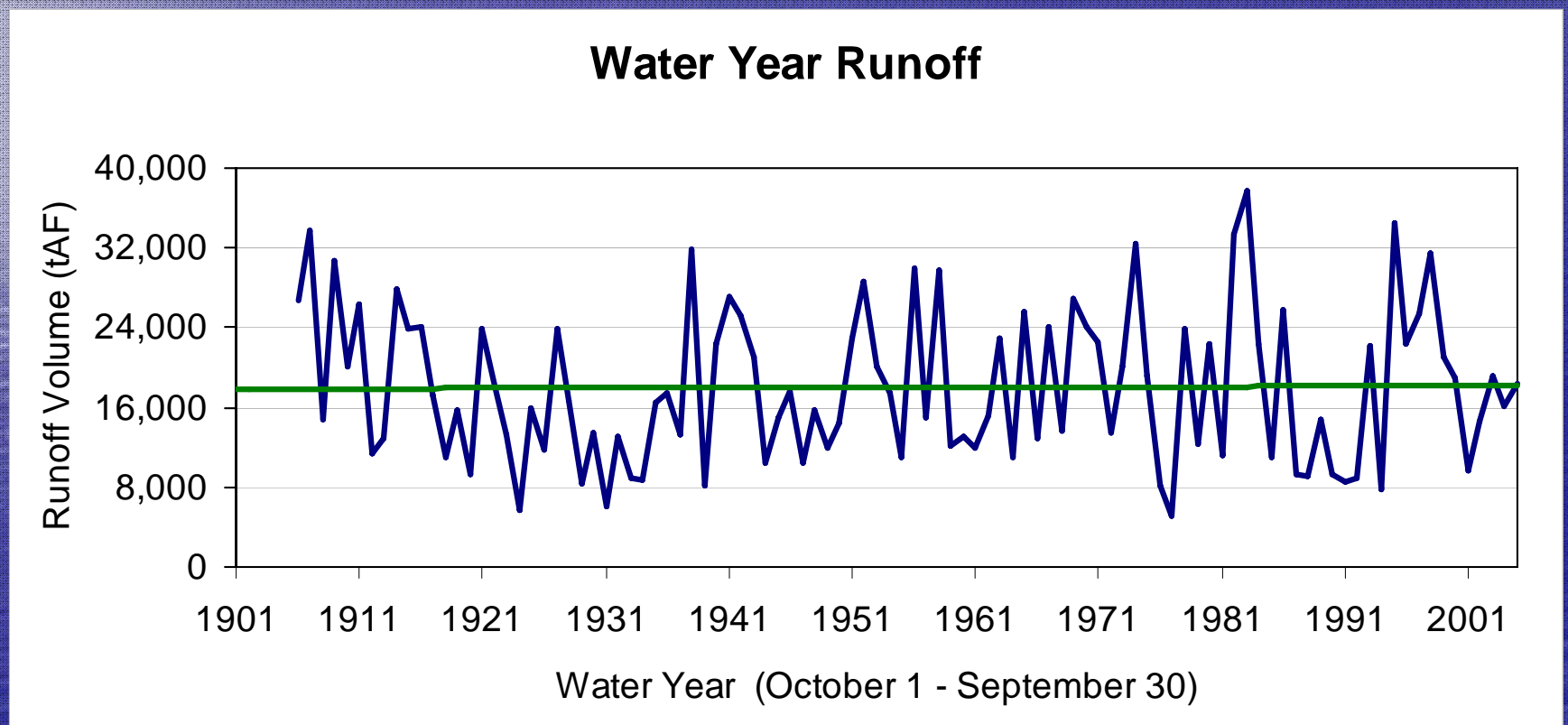
Historical Trends – Runoff Timing

Sacramento River System



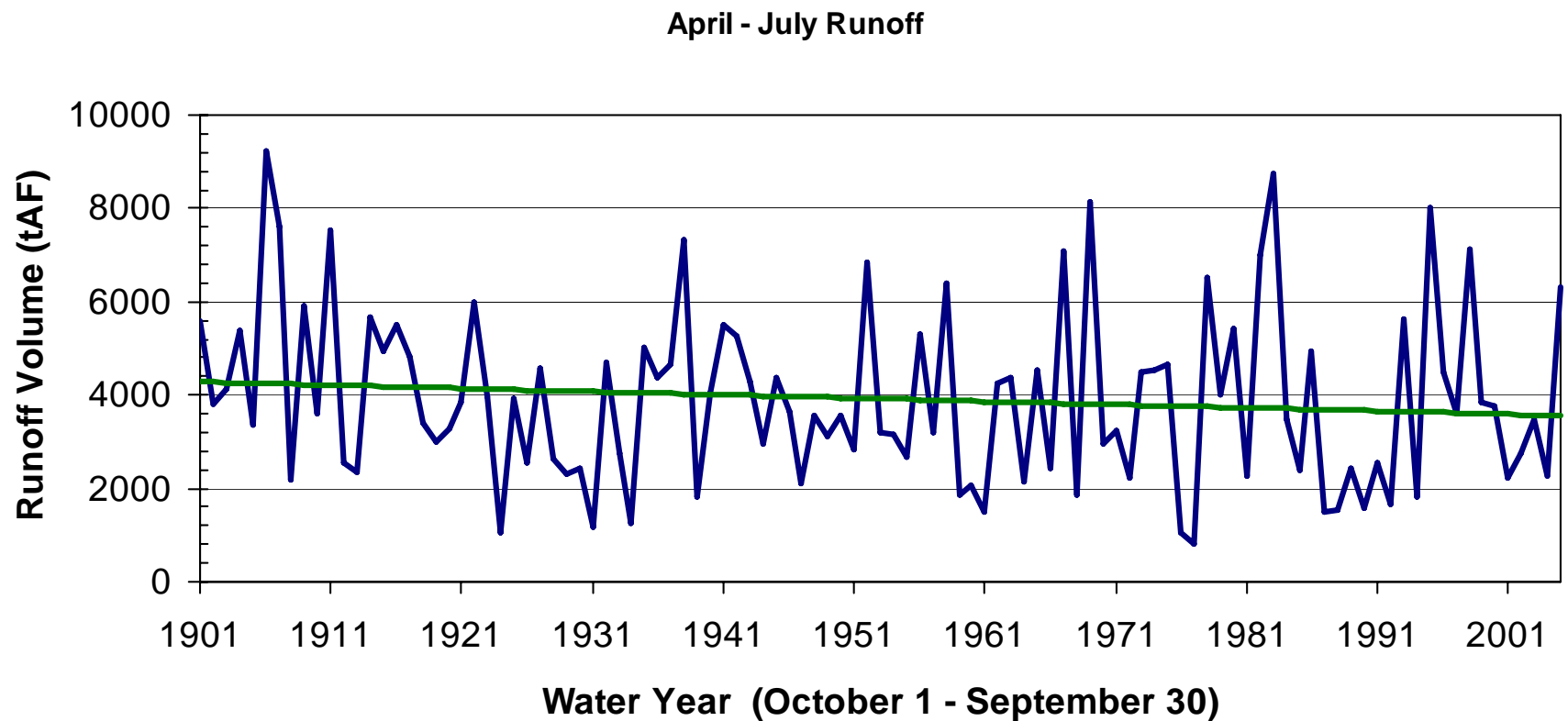
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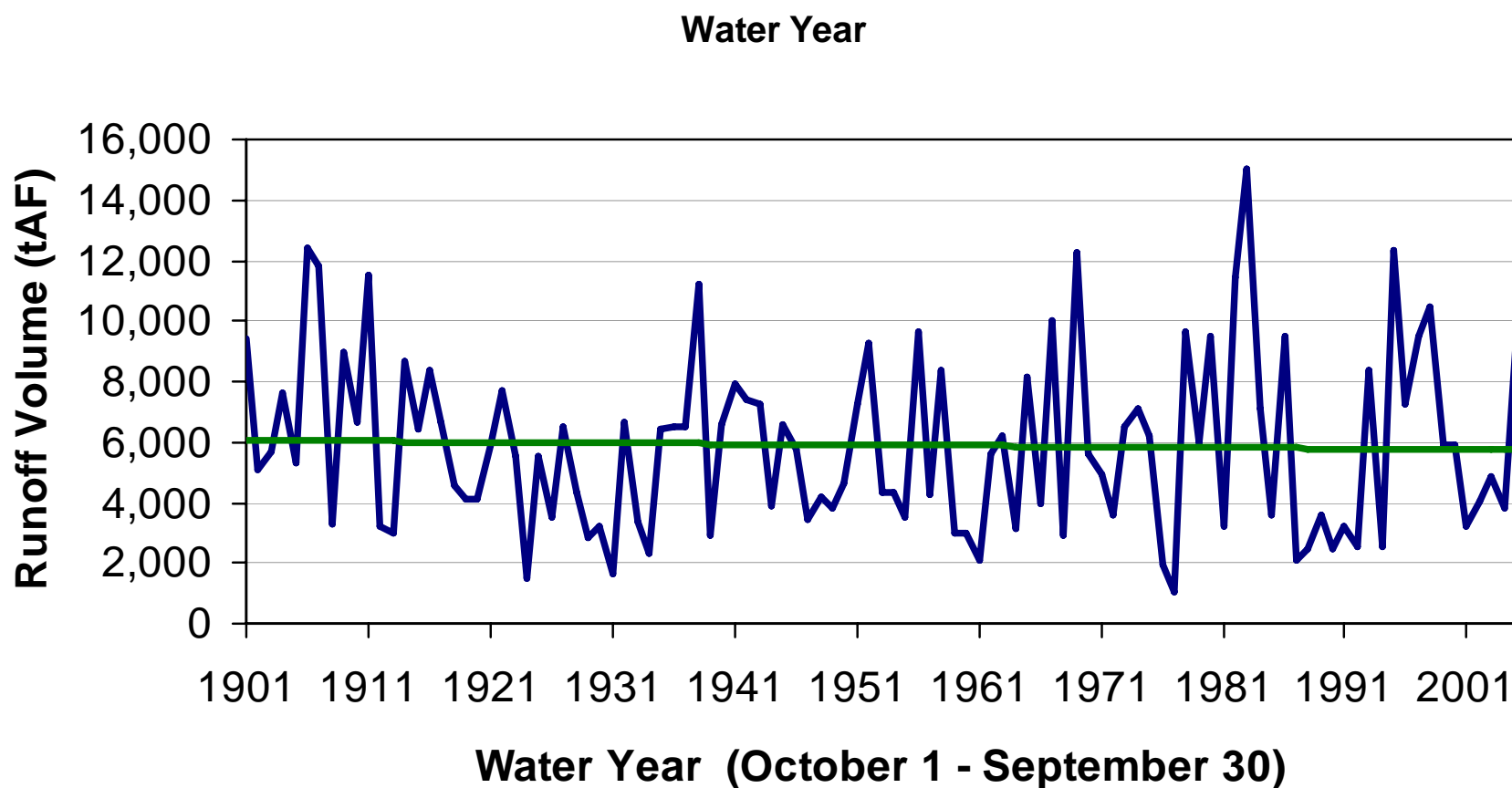
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San Joaquin River System



Historical Trends – Runoff Timing

San Joaquin River System

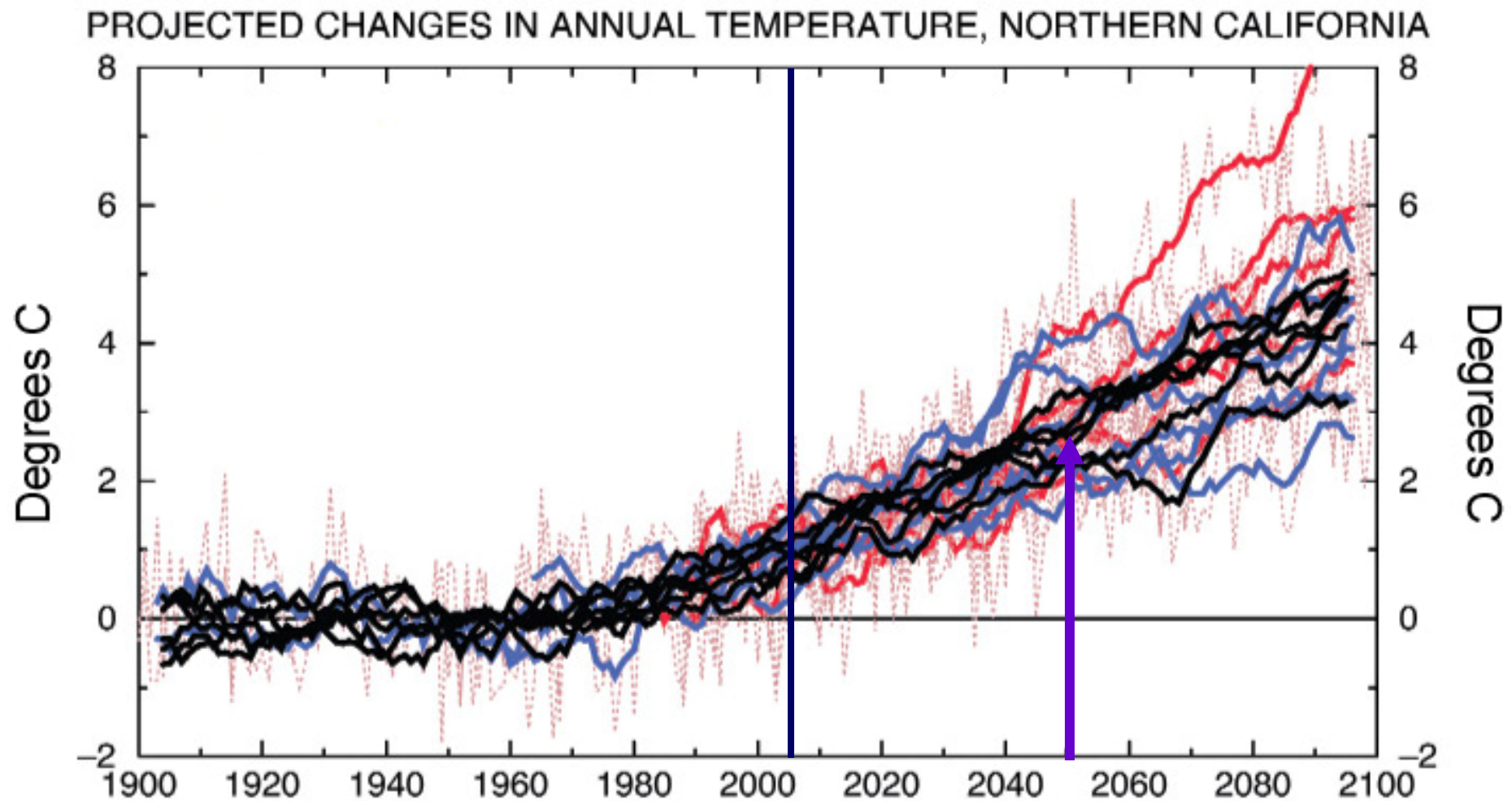


A look ahead...

Climate change model data from
GCMs statistically downscaled
over California

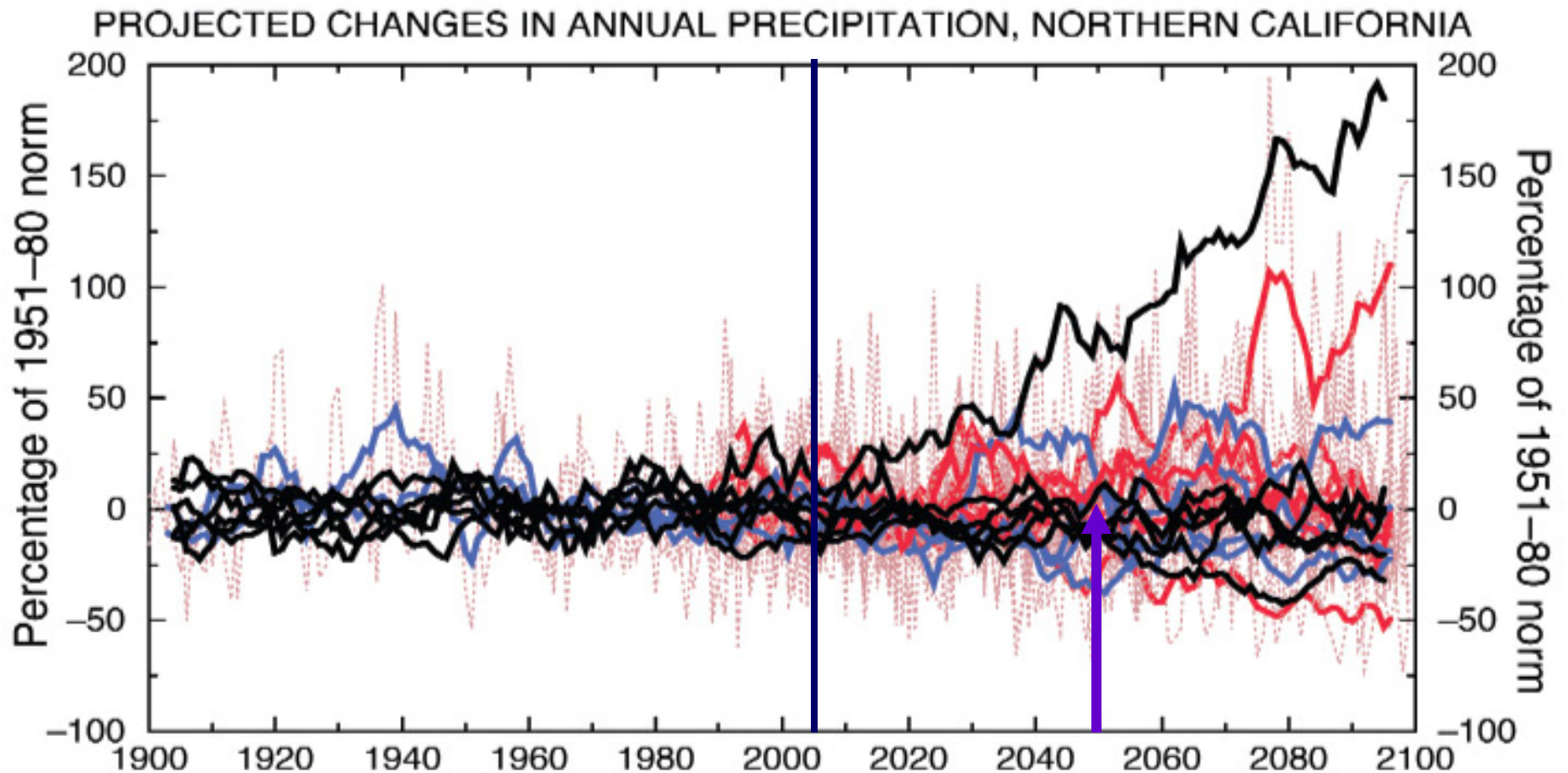


Projected Changes Temperature



Some Uncertainty From Dettinger, 2005

Projected Changes Precipitation



Lots of Uncertainty !

From Dettinger, 2005

Analysis of Projected Changes

- There is less variability in air temperature projections vs. precipitation projections
- GCMs need refinement before flood/drought frequency analysis appropriate
- Analysis focuses on impacts of potential temperature changes



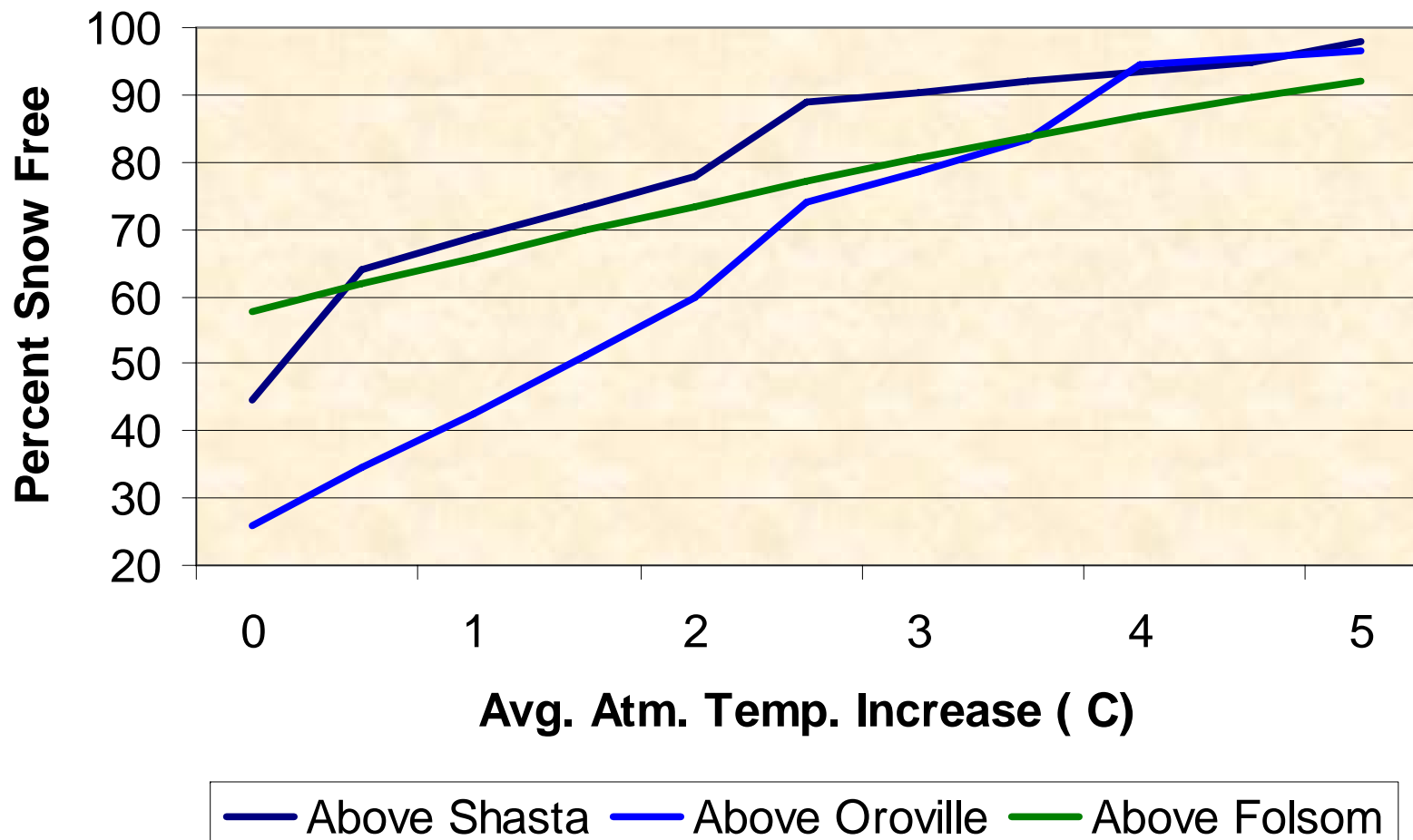
Snowpack Reduction Impacts

- A 3° C increase could result in a 33% decrease in Sierra Nevada snowpack (~5 MAF loss in snow water storage)
- North more sensitive to change than south
- Feather basin snowpack area decreases from 72% to 20% for a 3° C warming and to 2% for a 5° C warming

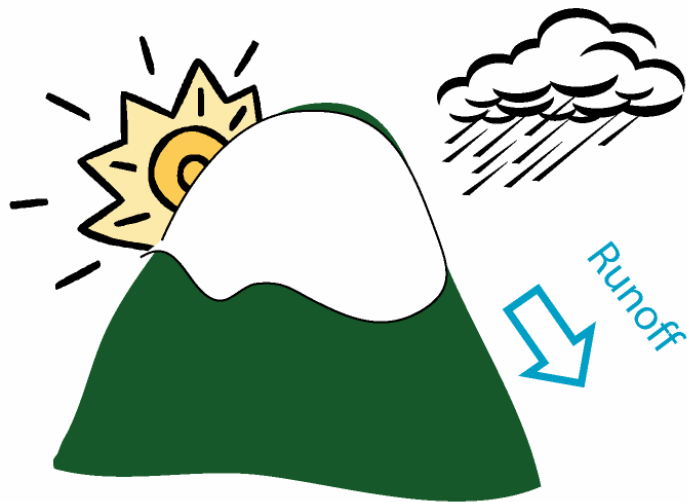
Values assume a 500 ft increase in snow line for each degree Celsius warming.



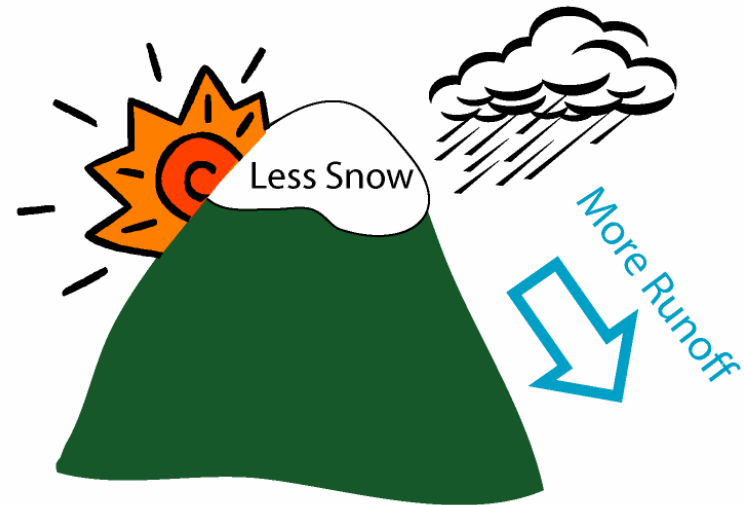
Snowpack Reduction Impacts



Storm Runoff Impacts



Present Conditions

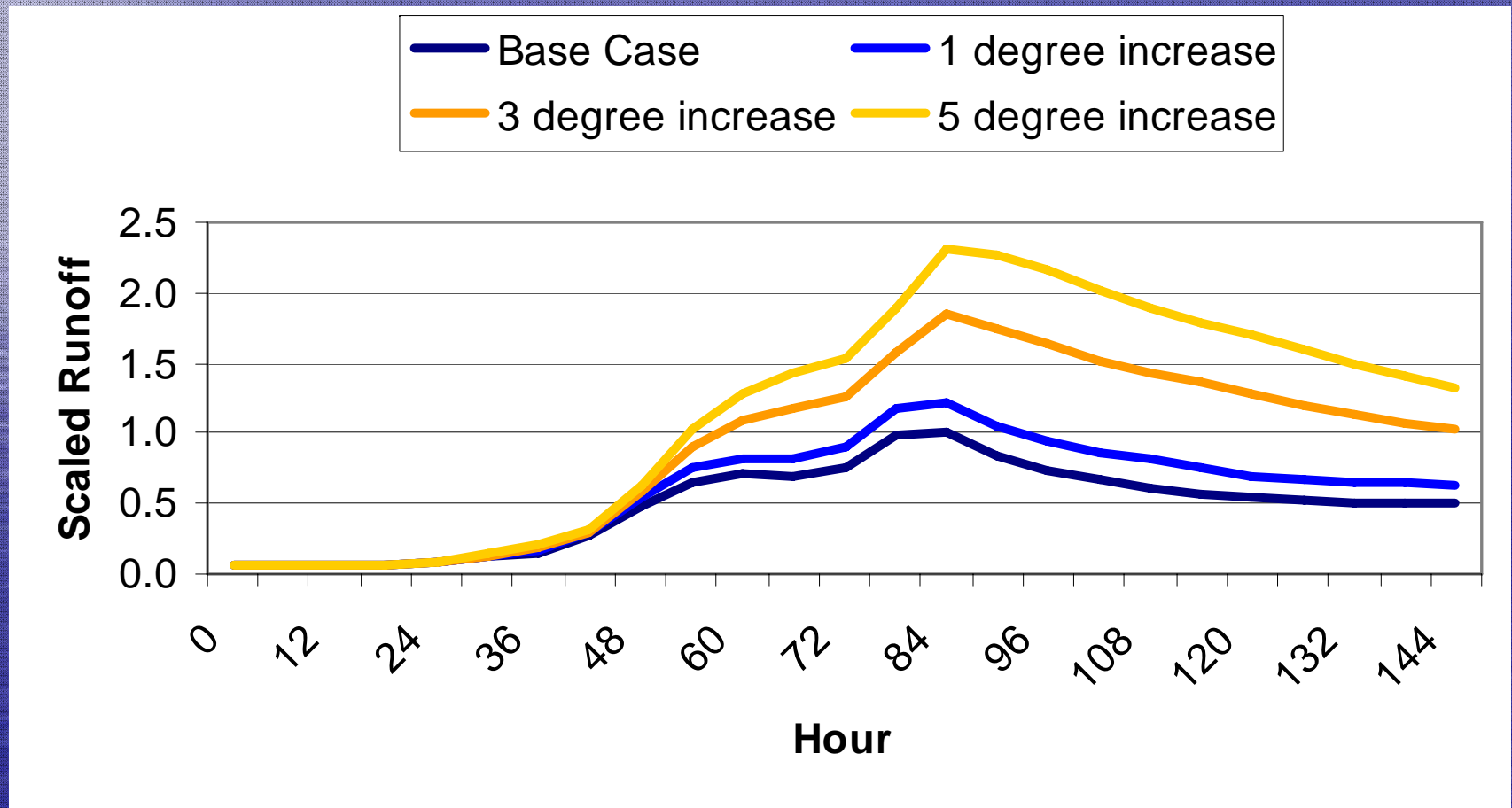


Increased Air Temperature



Storm Runoff Impacts

- Higher snow levels yield more direct runoff per storm



Water Supply/Flood Forecasting Issues

- Will climate change move snowmelt into the March transition period?
- Will there be more/fewer storms?
- Will the character of storms change and how will that affect forecasting?



Future Directions

- Continue analysis of historical data
- Evaluate new GCM data as available
- Study flood producing atmospheric circulations (historical and GCM data)
- Determine probability of occurrence of potential impacts
- Identify mitigation measures



G-10 IMG 8 FEB 06 TIME=23:00 UTC RES=16 KM NWS/WR-SSD

